

## Feeding parameters of young mallards (*Anas platyrhynchos*) and their effects on water quality of Lake Kis-Balaton, Hungary

By

J. JUHÁSZ and G. GERE\*

**Abstract.** Concerning their large density and fast metabolism, the aquatic birds take part an important role in the material cycle. It is important therefore to know the feeding parameters of different age classes of mallard. According to our result, over the studying of feeding characteristic of omnivorous mallards, we consider that the chemical compositions of their feces reflected the characters of the differences between the different feeding groups. The N-content of piscivorous cormorant feces was almost 8 times higher than the same volume of herbivorous geese. The N-content of omnivorous mallards occurred between them. That is why, it is reasonable to study the effects on water quality of the different feeding groups of aquatic birds.

By means of the large density and fast metabolism of aquatic birds, they play an important role in the aquatic material cycle. But their production-biological role was not known entirely. There were especially few data concerning the young birds. It was true but nowadays the number of experiments seemed to become higher (e.g. Juhász, Andrikovics & Gere, in press). Many experiments and calculations were made with cormorants that take away considerable organic matter from the water (Gere & Andrikovics, 1986). Recently, the old and the new data on the feeding habits of the cormorants were summarized (van Dobben, 1995).

In Hungary, the herbivorous Grey-lag goose and another geese were investigated in the field (Sterbetz, 1992) and in captivity (Andrikovics, Gere & Futó, 1997; Andrikovics, Gere & Lelkes, 1998; Juhász, Gere & Andrikovics, 1999). Omnivorous ducks were also investigated (Gere & Andrikovics, 1994).

Food of common aquatic birds analyzed their gut content around the Lake Balaton was studied (Ponyi, 1992). Effects of these birds for the trophic level proved rather complicated. These problems conducted us to repeat our earlier examinations. We simulated more accurately the wild conditions and used ten young mallards in our lab-experiments.

---

\*Judith Juhász and Dr. Géza Gere, ELTE Állatrendszertani és Ökológiai Tanszék (Department of Systematic Zoology and Ecology of the Eötvös Loránd University), 1088 Budapest, Puskin u. 3, Hungary.

Table 1. Production-biological parameters of young mallards (Group I, average of 3 birds)

| Date in 1998 | Type of food       | Consumed food (g) | Growth (g) Living mass | Growth (g) Dry mass | Feces (g) | P/C 100 | FU/C 100 |
|--------------|--------------------|-------------------|------------------------|---------------------|-----------|---------|----------|
| 06/06        | Special mixed food | 117,90            | 38,66                  | 10,05               | 32,22     | 8,58    | 27,32    |
| 07/06        | Special mixed food | 89,44             | 25,33                  | 6,58                | 16,34     | 7,35    | 18,26    |
| 10/06        | Corn               | 63,00             | -12,66                 | -3,29               | 6,40      | -5,22   | 10,15    |
| 11/06        | Corn               | 69,03             | 2,61                   | 0,67                | 28,06     | 0,97    | 40,64    |
| 15/06        | *Mixed food        | 38,58             | 12,00                  | 3,12                | 10,72     | 8,08    | 27,78    |
| 16/06        | *Mixed food        | 41,72             | 13,20                  | 3,43                | 17,58     | 8,22    | 42,78    |
| 22/06        | Special mixed food | 36,66             | 14,00                  | 3,64                | 9,11      | 9,92    | 24,84    |
| 23/06        | Special mixed food | 43,86             | 14,92                  | 3,87                | 10,65     | 8,82    | 24,28    |
| 31/07        | *Mixed food        | 46,98             | 14,00                  | 3,64                | 10,42     | 7,74    | 22,17    |
| 01/08        | *Mixed food        | 54,21             | 17,30                  | 4,49                | 20,05     | 8,28    | 36,98    |

P = production, increasing of body mass in dry weight. (The water content of mallard was considered 74%; Austin, 1976), FU = feces + urin, C = consumption (in air dried material), \* = composition of food: corn, grass, insect larvae and snail.

## Materials and methods

### *Field observations*

Ornithological observations were carried out in the territory of Lake Kis-Balaton. The population size of the mallard was counted. We observed the regular resting and feeding places of the birds and registrated the time interval when they stay in the water and in the land. This work was conducted by Lelkes and

### *Feeding experiments*

30-35 days young mallards were used in our experiments. Before the beginning of the experiments, we made accustomed the birds to captivity. Twocaptivity. Two mallards were put in a cage measured 2.25 m<sup>2</sup>. The bottom of cages were done from plastic screen. Under the cages, changeable, collectingtrays were put down. The birds were fed by measured food every day and the est of the food also measured after 24 hours. So the consumption, the feces and changes of birds body mass were registrated. In one part of the

*Table 2. Production-biological parameters of young mallards (Group II)*

| Date  | Type of food       | Consumed<br>food (g) | Growth (g)<br>Living mass | Growth (g)<br>Dry mass | Feces (g) | P/C<br>100 | FU/C<br>100 |
|-------|--------------------|----------------------|---------------------------|------------------------|-----------|------------|-------------|
| 06/06 | Special mixed food | 70,52                | 25,30                     | 6,57                   | 13,85     | 9,31       | 19,63       |
| 07/06 | Special mixed food | 22,52                | 10,66                     | 2,77                   | 6,07      | 12,30      | 23,65       |
| 10/06 | Corn               | 49,60                | -4,00                     | -1,04                  | 9,81      | -0,02      | 10,77       |
| 11/06 | Corn               | 57,80                | 13,70                     | 3,56                   | 30,01     | 6,15       | 51,92       |
| 15/06 | *Mixed food        | 44,59                | 20,00                     | 5,20                   | 13,27     | 11,66      | 29,76       |
| 16/06 | *Mixed food        | 59,16                | 21,30                     | 5,53                   | 18,09     | 9,34       | 30,57       |
| 22/06 | Special mixed food | 110,61               | 26,00                     | 6,76                   | 27,01     | 6,11       | 20,99       |
| 23/06 | Special mixed food | 91,08                | 19,00                     | 4,49                   | 23,00     | 5,42       | 25,25       |
| 31/07 | *Mixed food        | 58,91                | 10,66                     | 2,77                   | 22,03     | 4,70       | 37,39       |
| 01/08 | *Mixedfood         | 67,38                | 14,70                     | 3,82                   | 30,11     | 5,66       | 44,68       |

experiment, special, artificial, plant and animal like material composed by the Purina firm was partly fed by the ducks. This special mixed food – according to the observations – especially satisfied the ducks requirements. The artificial food contained 16.5% protein, 3% fatty material and 5.5% plant material. In other case, the ducks were fed with grits corn. In also another cases, mixed food of corn, grass, insect larvae and snail were used to feed the mallards. Measurements usually took place in air dry conditions. Grass was measured in the form of fresh weight, but also control samples were used to establish the water content of the grass.

### *Analytical methods*

The N-content of the samples was determined by the Kjeldahl-method. The P-content was measured by the photometry-method. The usual method was modified. During the wet burning, we used mixed nitric acid and hydrogen peroxide, because the carbonization was lower degree. In the case of atmospheric approach used by sulfuric acid, large quantity of activated carbon came into which adsorbed a lot of measurable material, so the mistake of measurement would be high.

*Table 3. Data from the nitrogen and phosphate content of the excrement of mallards*

| Data in 1998 | Type of food      | Total nitrogen % | Excrements $\text{PO}_4^{3-}$ mg/kg | Total phosphorus mg/kg |
|--------------|-------------------|------------------|-------------------------------------|------------------------|
| 06/06        | Special mixedfood | 3.43             | 2.52                                | 0.82                   |
| 07/06        | Special mixedfood | 3.40             | 2.92                                | 0.95                   |
| 10/06        | Corn              | 3.37             | 2.70                                | 0.88                   |
| 15/06        | *Mixed food       | 2.44             | 3.16                                | 1.03                   |
| 22/06        | Special mixedfood | 3.84             | 2.60                                | 0.84                   |
| 31/07        | *Mixed food       | 4.21             | 1.80                                | 0.58                   |

## Results and evaluations

### *Results of field examinations*

The role of mallard in eutrophication is very complicated. In 1997 the result of the census of mallard population was as follows: nesting population 500-560 pairs; wintering, migrating population from October 1997 to April 1998 changed between 2500-10,300 individuals.

The young mallards feed from the water but they rest and defecate on the shore, so they take organic materials from the water but they reduce the trophic level of the water. The adult birds mainly feed from the land and called on the water, they put main part of their feces into the water, they increase the eutrophication (Gere & Andrikovics, 1994).

### *Results of feeding experiments and lab-investigations*

The data of food consumption and the produced feces were tabulated in the Tables 1 and 2. These Tables show that for the young ducks the special mixed food was the most optimal food; in this case the amount of waste matter was the lowest. The level of sorting out was between 18.26% and 27.32%.

Nitrogen content of excrements produced by piscivorous cormorants was between 13-15% The nitrogen content of excrement of mallard changed between 2.44%-4.21%. This value in the case of the herbivorous Grey-lag goose was only 2.2% (Juhász, Gere & Andrikovics, 1998). The significant alternations of the nitrogen content in the excrements showed the differences in the feeding types of aquatic birds. It is worth for mentioning that in the excrement of young mallards the phosphorus content was significantly lower than it was found in the case of the cormorants or Grey-lag goose. The

phosphorus content of young duck excrement was only under the 0.01%. The phosphorus content of cormorants excrements changed between 4.5% and 5.5% (Gere & Andrikovics, 1992) and in the case of Grey-lag goose was 0.43% (Juhász, Gere & Andrikovics, 1998). The above mentioned facts showed for us that the aquatic birds with different feeding types took different role in the eutrophication processes. The population size of the mallard was very high in the Kis-Balaton territory, so their direct effects to the inner loading might be also significant.

## Summary

The density of mallards in Kis-Balaton was very high in 1997. These were no exact data of droppings concerning the young birds. The nitrogen and phosphorus content of their droppings were analyzed and compared with the same data of cormorants and Grey-lag goose. The nitrogen content of young ducks was 2.44% to 4.21%. It was much more lower than it was found in the case of piscivorous cormorants and it was little higher than it was measured in the case of young geese.

The phosphorous content of the droppings was extremely low in the case of the young ducks. The all data were under the 0.01%. These data concerning the excrement of young aquatic birds showed that – not surprisingly – the role of the omnivorous ducks in the eutrophication is rather complex, but if the density of the birds is high, they very often increase the trophic level of aquatic ecosystems.

**Acknowledgements:** The authors thank András Lelkes for his help providing the population size data of mallards in Kis-Balaton.

## REFERENCES

1. ANDRIKOVICS, S., GERE, G. & LELKES, A. (1996): A nyári lúd hatása a Kis-Balaton eutrofizációs folyamataira. – 2. Kis-Balaton Ankét Keszthely, 1996. szeptember 9-11.: 504-513.
2. ANDRIKOVICS, S. & GERE, G. (2000): Direct and indirect effects of aquatic birds on lotic and lentic habitats. – *Sylvia, Journ. Ornithol.*, Praha: 36-47.
3. AUSTIN, G. T. (1976): Body composition and organ weight of the vertin (*Auriparus flaviceps*). – *GT. Basin Nat.*, 31: 66-68.
4. GERE, G. & ANDRIKOVICS, S. (1986): Untersuchungen über die Ernährungsbiologie des Kormorans (*Phalacrocorax carbo sinensis*) sowie deren Wirkung auf den trophischen Zustand des Wassers des Kis-Balaton, I. – *Opusc. Zool. Budapest*, 2: 67-76.

5. GERE, G. & ANDRIKOVICS, S. (1990): Effects of some waterflows to the water quality. – Soc. Int. Limnologiae, „The Dynamics and Use of Lacustrine Ecosystems”, Helsinki.
6. GERE, G., ANDRIKOVICS, S., CSÖRGŐ, T. & TÖRÖK, J. (1990): A kárókatonák (*Phalacrocorax carbo*) szerepe a Kis-Balaton vízminőségének alakításában. – A Magyar Madártani Egyesület II. Tudományos Ülése, Szeged, p. 88-94.
7. GERE, G. & ANDRIKOVICS, S. (1991a): Feeding of different waterfowls and their effects on the water quality. – „Aquatic Birds '91”. Internat. Symp. Aquatic Birds, Sackville, New Brunswick, Canada, p. 10.
8. GERE, G. & ANDRIKOVICS, S. (1991b): Untersuchungen über die Ernährungs-biologie des Kormorans (*Phalacrocorax carbo sinensis*) sowie deren Wirkung auf den trophischen Zustand des Wassers des Kisbalaton, II. – Opusc. Zool. Budapest, 24: 115-127.
9. GERE, G. & ANDRIKOVICS, S. (1992a): Effects of waterfowl on water quality. – Hydrobiologia, 243/244: 445-448.
10. GERE, G. & ANDRIKOVICS, S. (1992b): A kárókatonák (*Phalacrocorax carbo*) szerepe a Kis-Balaton szervesanyag forgalmában. – Aquila, 99: 27-32.
11. GERE, G. & ANDRIKOVICS, S. (1994): Feeding of ducks and their effects on water quality. – Hydrobiologia, 279/280: 157-161.
12. JUHÁSZ, J., GERE, G. & ANDRIKOVICS, S. (1998): Felnőtt nyári ludak produkcióbíológiai paramétereinek vizsgálata, és hatásuk a Kis-Balaton vízminőségének változására. – Acta. Acad. Ped. Agriensis, 22: 47-59.
13. PONYI, S. (1992): Abundance and feeding of wintering and migrating aquatic birds in two sampling areas of Lake Balaton in 1983-1985. – Hydrobiologia, 279/280: 63-69.
14. STERBETZ, I. (1994): A Balatonon telelő északi vadlúd tömegek exkrétum-produkciója. – Aquila, 99: 33-40.
15. VAN DOBBEN, C. M. (1995): The food of the cormorant, *Phalacrocorax carbo sinensis*: Old and new research compared. – Ardea, 83: 139-143.